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# BIOLOGICAL EVALUATION OF CONIFER MORTALITY ON THE PROPOSED SMITH SALVAGE SALE, KLAMATH NATIONAL FOREST

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## ABSTRACT

Conifer mortality was associated with the removal of water that had flowed in a ditch right-of-way until 4-5 years ago. Ponderosa pine was by far the most numerous tree species killed. Significant pests identified in the area were the western pine beetle and the western dwarf mistletoe. Management options to capture mortality and to improve the health and vigor of the affected stands are compared with the no-action option.

## INTRODUCTION

In response to a request from Gary Barnett of the Scott River Ranger District, Klamath National Forest, we examined the Miners Creek area (T.40 & 41N., R.9W., Sec. 3 & 34) with Mike Schafer (Supervisor's Office), Bob Williams (California Department of Forestry), and Gary Barnett and Mary Lou Chopelas (Scott River Ranger District), on August 20, 1981. The objectives were to determine the cause of conifer mortality and to present management options which would reduce pest problems and prevent additional mortality.

## OBSERVATIONS AND DISCUSSION

The proposed Smith Sale is located in a low elevation, low site, mixed conifer stand about 100 years old. Black oaks are intermixed throughout the stand. Tree mortality is conspicuous along a ditch right-of-way that had carried water until 4 to 5 years ago. Although in some cases mortality

is present a considerable distance from the dry ditch, the pattern of dead trees is clearly associated with the ditch, and the initiation of mortality corresponds with stopping the use of the ditch to convey water through the area.

Numerous ponderosa pines and incense-cedars, some white firs, one sugar pine and one Douglas-fir have died. Dead ponderosa pines considerably outnumber the other tree species. Most mortality occurred one to three years ago, as indicated by the degree of needle and twig loss and by conks of the sap rot fungus, Cryptoporus (Polyporus) volvatus. A few live Douglas-fir were thin-crowned.

The only important insect pest identified in the examination was the western pine beetle, Dendroctonus brevicomis. All dead ponderosa pines examined had evidence of past western pine beetle activity, and two trees in the vicinity were currently under attack by the western pine beetle. Other insects found in ponderosa pine and other tree species - including the turpentine beetle (D. valens), roundheaded borers, and flatheaded borers - are usually considered secondary. Western dwarf mistletoe (Arceuthobium campylopodum) was present on some of the overstory ponderosa pines. No evidence of root diseases was noted.

A combination of high basal area, a change in water conditions, and subsequent western pine beetle activity is responsible for the mortality we observed. The mortality was apparently triggered by blocking the water that had been flowing in the ditch and by the general drought conditions existing in 1976-78. Tree mortality peaked about 1979 or 1980.

## BIOLOGY OF PEST ORGANISMS

### Western Pine Beetle

The western pine beetle is an aggresive and opportunistic pest of ponderosa pine in northern California, where it produces about two generations per year. All stages of the beetle are protected and confined beneath the bark of infested trees except for a brief period in its life when the adult flies in search of susceptible hosts. Flights to search out new hosts occur during the warmer parts of the year, when sustained air temperatures are above about 50°F, and usually peak in late May and June and again in late July and August. Infested trees can be recognized and confirmed by several symptoms: a) fading (a yellowing and reddening of the the needles as trees die), b) sawdust and pitch tubes (globular sawdust and pitch mixtures pushed out of entrance holes by the beetles), c) woodpecker work (a characteristic pattern of bark flaking by woodpeckers as they feed on beetle larvae, particularly during the overwintering period), and d) the presence of the beetles and characteristic beetle galleries beneath the bark. Vigorous trees are unattractive to beetles which land on them; those that do attempt to chew their way through the outer bark into the phloem-cambium region find their way blocked by copious flows of pitch. Suitable and susceptible host trees for the western pine beetle typically are ponderosa pines which are unthrifty and, as a consequence, are unable to pitch-out attacking "pioneer" beetles. This unthrifty or predisposed-to-beetle-attack condition may be due to one or a combination of two or

more interacting factors such as dwarf mistletoe or root disease infection, injury or disturbance caused by fire, lightning, road construction and logging activity, overstocking for the site, crown decadence associated with advanced age, and drought. When the "pioneer" beetles are successful in attacking a susceptible host tree, they emit powerful chemical messengers - aggregating pheromones (commonly referred to as sex attractants) - which signal the many other western pine beetles in the area to come and invade the same tree. Adult beetles also carry spores of a wilt-causing blue-stain fungus. During attack, the fungal spores dislodge, germinate, and, within just a few weeks, the fungus blocks the conductive vessels in the inner-bark and sapwood, effectively girdling the tree. When beetles in a given area are abundant, vigorous non-susceptible host trees growing near susceptible attacked hosts may succumb to attack because of the combined effects of the aggregating pheromone and resultant mass attack and the blue-stain fungus.

WESTERN DWARF MISTLETOE

The western dwarf mistletoe is specific to ponderosa pine in the area we examined and will not infect Douglas-fir, white fir or sugar pine. Because dwarf mistletoes are obligate parasites, they are completely dependent on their host for water and for most of their mineral and organic nutrients. Infection can cause growth reduction, abnormalities in tree form, predispostion to other pests, and mortality. Infected trees appear to be more susceptible to attack by bark beetles than do uninfected trees. Mortality is more frequent in dwarf mistletoe-infected trees growing on poor sites than on good sites and when other stress factors occur, such as drought or competition in overstocked stands.

Dwarf mistletoes spread between trees and within crowns of trees by small seeds that are forcibly ejected into the air. Spread from overstory to susceptible understory is limited to the distance the seeds are dispersed, generally 20 to 60 feet, but as much as 100 feet if assisted by wind or if the trees are on steep slopes.

## MANAGEMENT OPTIONS

Management options available to the District include the following:

1. No Action: Past tree mortality can be attributed to moisture stress and overstocking which, in the case of ponderosa pine, predisposed the trees to bark beetle attack. Future losses could be at low levels, but predisposing factors such as competition and dwarf mistletoe in combination with the probability of drought will remain; therefore, mortality that may interfere with goals and objectives should be expected. Standing mortality will deteriorate and salvage value will be lost.

2. Salvage Mortality: This option will remove dead trees and realize some economic value from the killed timber. This option alone will not mitigate the identified predisposing factors nor improve the resistance of the stand to stresses accumulating with increased basal area and probable drought.

3. Salvage in Combination with Thinning and Poor-Risk Tree Removal: In addition to removing dead trees, green trees would be removed to alleviate overstocking. Poor-risk trees - trees not expected to survive for 10 years - would be part of the component removed. Also, where a choice exists, overstory trees infected with dwarf mistletoe should be cut in preference to noninfected trees. (See R-5 Supplement No. 108, September 1971 -- 2471.32 - Thinning (Merchantable-Under-Rotation-Age Stands) and 2471.32a - Marking Guidelines for Thinning). If it is helpful in identifying "must cut" trees, Keen's crown vigor classes can be used as a marking guide, particularly for the pine (see attachment).

This treatment would decrease competition in the residual stand and thus reduce the likelihood of large-scale tree killing by bark beetles in the area even if a severe and extended drought should occur. Additional benefits may accrue to the treated area, such as a reduced risk of fire by not having large numbers of beetle-killed trees present throughout the stands.

Thinning will produce green slash which could provide opportunities for buildup of pine engravers (Ips spp.). These species can breed in fresh green slash and subsequently attack the tops of living trees. One way to minimize this problem is to conduct activities that will produce slash in only late summer, fall, or early winter. Usually fewer beetles are flying during this time and the slash is likely to dry out before the beetles can complete their development. If green slash is produced during the spring and early summer, it should be treated within a month of the cutting. Slash treatment alternatives include removal from the area, chipping, piling and burning, crushing with logging equipment, and lopping and scattering the slash in the open to increase the rate of drying.

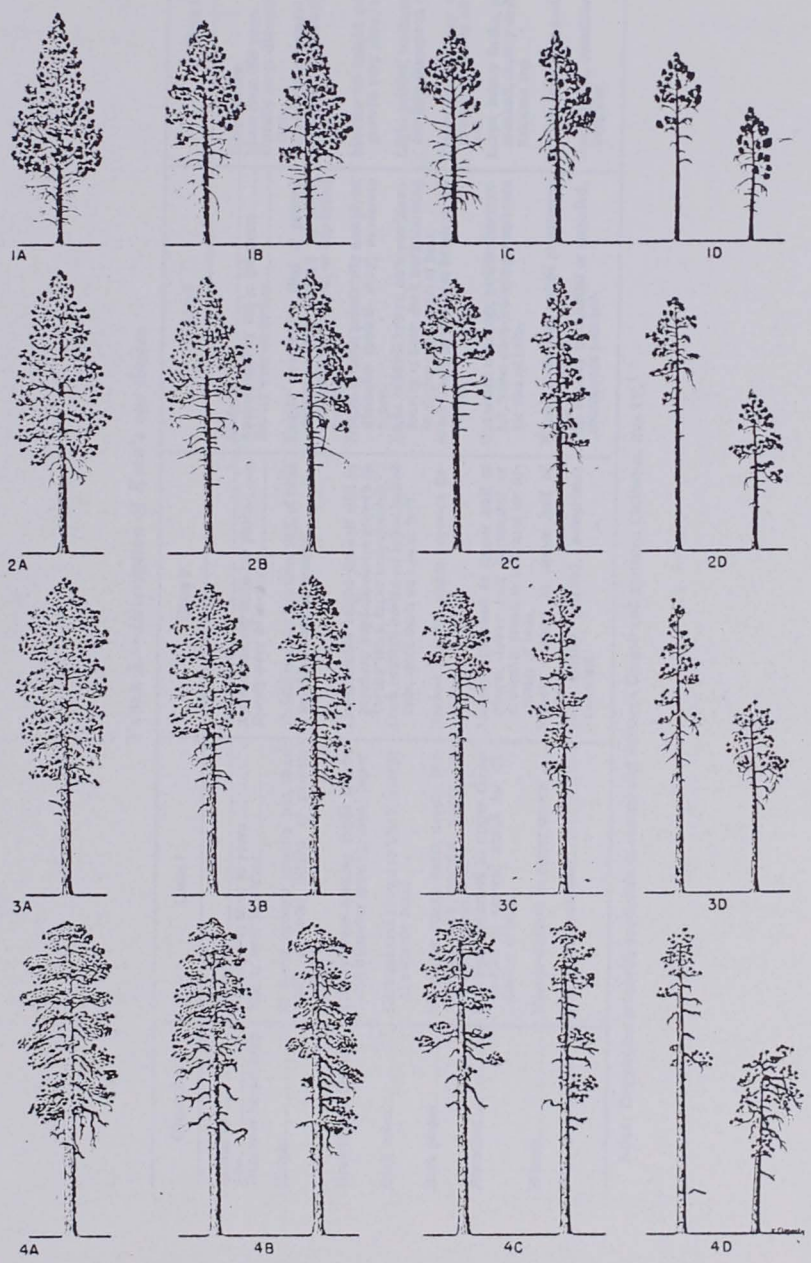


FIGURE 40.—A ponderosa pine tree classification based on age and vigor.

TABLE 3.—*Description of Keen's age classes*

| Character | Class 1 | Class 2 | Class 3 | Class 4 |
|---|---|---|---|---|
| Maturity | Young | Immature | Mature | Overmature. |
| Age | Usually less than 80 years | Approximately 80 to 180 years | Approximately 180 to 300 years | More than 300 years. |
| Diameter breast high | Rarely over 20 inches | Rarely over 30 inches | Rarely over 40 inches | Usually large diameters in dominant trees. |
| Height | In lower canopy usually less than 60% of total height of mature canopy. | Height usually less than 90% of total height of mature canopy. | Height practically that of general crown canopy (except of intermediate, suppressed, or top-killed trees). | Full height of general canopy (except suppressed, spike-topped or broken trees). |
| Growth and taper | Thrifty trees making rapid height and diameter growth; rapid taper. | Considerable height growth still in progress; good diameter growth in thrifty trees; taper considerable. | Height growth practically complete; diameter growth slow; moderate taper. | Making no height growth; diameter growth very slow; least taper. |
| Bark color | Dark grayish brown to black (except at extreme base). | Dark reddish brown on lower half of bole; dark bark on upper half. | Light reddish brown on lower three-fourths of bole; dark bark showing in upper one-fourth of bole. | Light yellow; uniform color throughout bole (except at extreme top). |
| Bark plates | No plates; rough bark, deeply furrowed, with narrow ridges between fissures. | Narrow smooth plates between fissures. | Moderately large plates between fissures. | Plates usually very wide, long, and smooth; fissures often rather shallow. |
| Branches | Branches upturned in upper three-fourths of crown; small for diameter of bole. | Mostly upturned in upper half of crown; lower half horizontal or drooping; small to medium for diameter of bole. | Upturned near top; middle horizontal; lower ones drooping; moderate for size of bole. | Large, heavy limbs, often gnarled or crooked; mostly drooping, except in extreme top. |
| Whorls | Whorls distinct in upper crown | Whorls distinct in upper half of crown. | Whorls indistinct except at extreme top of crown. | Whorls indistinct and incomplete. |
| Top | Top usually pointed | Top usually pointed, sometimes rounded. | Top usually pyramidal or rounded, sometimes pointed. | Usually flat, occasionally rounded or irregular. |

NOTE: Description primarily applicable to central and southern Oregon and northern California, Site IV.

TABLE 4.—*Description of Keen's crown-vigor classes*

| Character | Class A | Class B | Class C | Class D |
|---|---|---|---|---|
| Crown vigor | Full, vigorous | Good to fair | Fair to poor | Very poor. |
| Crown length | Long, 55% or more of total height; or less only if more than average width. | Average length, less than 55% of total height (approximately 30% to 55% if full and wide), or a longer crown if narrower or somewhat thin. | Short (from 10% to 30% of height, if crown of normal density) or long, sparse, and narrow. | Very short (less than 10% of total height), sometimes merely a tuft at top of tree, or somewhat longer when sparse and ragged. |
| Crown width | Usually average width or wider (narrower if very long and dense). | Usually average width or narrower; may be flat on one side. | Usually narrow or flat on one or more sides. | Usually very narrow and sparse, or limbs all on one side. |
| Crown density | Usually full and dense or of medium density if longer than 55%. | Usually of full to medium density, not sparse or ragged. | Often sparse and ragged except at very top. | Sparse and ragged. |
| Foliage | Needles of average length or longer, usually dense and thrifty. | Needles of average length, usually dense and thrifty. | Needles often short and thinly distributed, but of normal length and density when confined to top one-third of crown. | Needles often short, foliage sparse or scattered or only partially developed, but of normal length if reduced in quantity. |
| Position | Usually isolated or dominant, rarely codominant. | Usually codominant; sometimes isolated or dominant; rarely intermediate. | Usually intermediate; sometimes codominant or suppressed, but rarely isolated or dominant. | Usually suppressed or intermediate, but may occupy other positions if greatly reduced in vigor. |
| Diameter | Large for age | Average or above for age | Usually below average for age; sometimes larger in decadent trees. | Decidedly subnormal for age, but very old, decadent trees may be of large diameter. |

NOTE: The descriptions apply to the usual types of trees found in each class; where exceptions occur, the size of living crown and amount of foliage are the primary considerations in determining the vigor class.